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**Original Research Article**

# Knowledge and Attitude Associated with Use of Performance Enhancing Substances and Methods among Mixed Martial Arts Athletes in Kenya

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## Abstract

The use of performance-enhancing substances (PES) among Mixed Martial Arts (MMA) athletes has been a growing concern in Kenya, driven by the desire to gain a competitive edge. This study explores the knowledge and attitudes associated with the use of PES, traditional herbs, and food supplements among Kenyan MMA athletes. The cross-sectional survey research design allowed for the collection of quantitative data to understand the athletes' perspectives. Participants in the study included MMA athletes from various regions across Kenya, with a target population of 4,000 athletes and a sample of 800 selected through Population Proportionate to Sample (PPS) technique. The research instruments used were questionnaires divided into two sections: Anti-Doping education and beliefs about PES, traditional herbs, and food supplements. Pre-testing ensured the reliability of the questionnaires. Data analysis utilized SPSS version 22, applying descriptive statistics and One and Two-Way Analysis of Variance to examine mean score differences at a 0.05 significance level. Results indicated that the majority of MMA athletes in Kenya are male (79.9%), with an age range of 18 to 54 years and a mean age of 26.8±4.1. Experience in years varied, with Wrestlers having the most years and Taekwondo athletes the least. Knowledge levels were generally low, with Bodybuilders scoring the lowest in a set of 16 Likert scale questions. Misconceptions about the safety of over-the-counter supplements were prevalent, with only 14.8% of athletes believing they were safe. Attitude scores showed that Bodybuilders and Weightlifters had a more favorable view of doping, while female athletes exhibited a significantly higher attitude score compared to males. The study concludes that there is a need for enhanced Anti-Doping education and awareness programs, particularly focusing on athletes with lower knowledge and attitude scores. Recommendations include implementing gender-specific education, promoting gender diversity in MMA, and strengthening collaboration with sports authorities and Anti-Doping agencies.

**Keywords:** Mixed Martial Arts (MMA), Performance-Enhancing Substances (PES), Doping, Traditional Herbs, Food Supplements, Kenya, Anti-Doping Education, Attitudes Toward Doping, Knowledge Assessment, Sports Ethics, Gender Distribution, Performance Enhancement, Anti-Doping Policy.



## INTRODUCTION

The use of performance-enhancing substances (PES) among mixed martial arts (MMA) athletes has become an issue of growing concern, with historical roots and contemporary repercussions. The evolution of mixed martial arts in Kenya has contributed to a greater recognition of these sports and has increased their appeal. Historically, performance-enhancing substances were used as early as 668 BC during the Olympic Games (El-Hamadi & Hunien, 2013). In the 1960s, the prevalence of doping in modern sports became more visible, with professional cyclists using amphetamines, leading to tragic outcomes such as the death of Tom Simpson in the Tour de France (El-Hamadi & Hunien, 2013).

With the transformation of sports from amateur to professional business, the industry has grown significantly, with a market valuation exceeding $500 billion (El-Hamadi & Hunien, 2013). This growth has made sports more competitive, with increased financial rewards and a heightened desire for success. Consequently, athletes may turn to performance-enhancing substances to gain a competitive edge (Schneider, 2016; Weldon, 2015). MMA encompasses various physically demanding sports, including Thai Wrestling, Judo, Karate, Jujitsu, Boxing, and Muay Thai, requiring strength, endurance, and resilience (Westney,

2012). These demands may drive athletes to seek substances that improve performance and help with recovery from injuries.

While the use of PES might be fueled by competitiveness and the allure of success, it also carries significant risks. Athletes using these substances may face health issues and legal consequences. Henning and Dimeo (2014) noted that athletes face stiffer penalties for using banned substances, including being stripped of titles and barred from competing in future events. Even legal performance-enhancing substances can have detrimental effects if not used in the right quantities (Pipe, 2011; Mahomoodally, 2013). The contamination of food supplements with banned substances during production can also lead to inadvertent doping (Newmaster *et al*., 2013). Additionally, some conventional medicines contain prohibited substances, posing a risk to athletes who unknowingly use them for medical purposes (Lee, 2006).

The government of Kenya, in response to these issues, has implemented various measures to combat doping, including enacting the Anti-Doping Act and aligning with World Anti-Doping Agency (WADA) guidelines (Chebet, 2014; Kamenju et al., 2016). Despite these efforts, the temptation to use PES persists, driven by the pressures of competitive sports and financial incentives. In this case, the study attempted to assess the levels of knowledge among selected martial arts sports regarding the consumption of food supplements and substances that enhance performance together with the attitude of the athletes.

## METHODS

### Research Design

The study utilized cross-sectional survey research design in guiding the research process. Appropriateness of the research design was attributed to ability to integrate different variables whose measurement is cost effective and consumes less time (Weiss *et al*., 2001). Weiss *et al*., (2001) argues that the design is crucial in the development of a representative picture about the characteristics of people including their attitudes. The research design was implemented by adopting a descriptive approach, where in this case, the study sought to investigate the levels of attitude, beliefs and knowledge about the use of performance-enhancing substance, traditional herbs and food supplements among Kenyan mixed martial artists. Quantitative techniques on the other focused primarily on numeric data to help in finding out accurate analysis of the knowledge, beliefs and attitude levels regarding the consumption of traditional herbs, performance enhancing substances and food supplements together with the methods of administration employed while primarily focusing on athletes engaging in mixed martial arts in Kenya.

### Study Location

The research was undertaken with a sample of 23 out of the 47 counties in the country. By doing so, the diverse locations provided the researcher with athletes in the sport from diverse backgrounds whose opinions are likely to be unique and thus a rich source for information for this study. The sampled counties were Nairobi, Kisumu, Kisii, Homabay, Kakamega, Bungoma, Busia, Uasingishu, nyeri, Nakuru, Marsabit, Garissa, Mombasa, Kwale, Elgeyo -Marakwet, Kilifi, Narok, Nakuru, Laikipia, Machakos, Meru, Tharaka-nithi and Kirinyaga.

### Target Population

In the study, the researcher targeted respondents from the six federations associated with mixed martial arts where the estimated population was 4000 athletes.

### Sampling Technique

Sampling was be done using the Population Proportionate to Sample (PPS) technique (Table 1).

| NO. | SPORT | Athlete Population | Sample Athletes |
|---|---|---|---|
| 1 | BOXING | 3000 | 591 |
| 2 | WEIGHTLIFTING | 60 | 12 |
| 3 | WRESTLING | 300 | 59 |
| 4 | BODY BUILDING | 200 | 39 |
| 5 | TAEKWONDO | 200 | 39 |
| 6 | KARATE | 300 | 59 |
| Total Sampled | | | 800 |

### Research Instruments

Questionnaires were the primary research instruments to collect data from the athletes. The individual questionnaires were divided into two sections based on the objectives of the study including, knowledge of the concept of doping and how the substances are used, and beliefs about performance enhancing substances, traditional herbs and food supplements. The researcher adapted the questionnaire from a social package developed by WADA (WADA, 2012). Furthermore, the researcher incorporated Petroczi's (2002) Performance Enhancement Attitude Scale (PEAS) in measuring the attitude of athletes in mixed martial arts towards doping and the methods involved. Measure of attitude was based on a 6-point Linkert scale ranging from strongly agree at 6, agree 5, slightly agree 4, slightly disagree 3, disagree 2 and strongly disagree 2.

**Pre-test of the tools**

The researchers undertook a pre-test of the questionnaire to test the effectiveness of the research instrument in collecting the required information before being taken to the field for actual data collection.

**Data Collection Procedures**

The researchers required respondents to sign the consent forms and taken through the research objectives before allowing them to participate in the study. The research assistants helped in guiding the mobile data collection data collection process and were present to respond to any inquiries raised by the respondents.

**Data Analysis and Presentation**

Having collected data through the aid of an Open Data Kit (ODK), the researchers downloaded from the server and cleaned ready for analysis using SPSS version 22. Descriptive statistical methods were used to summarize the analyzed data including aspects such as standard deviation, frequencies, mean, percentages and associated measures. The researcher used One and Two-Way Analysis of variance in testing the differences in the mean scores of the various variables at 0.05 level of significance.

**Approval Consideration**

Before undertaking the actual data collection process, the researcher sought Approval from Anti-Doping Agency of Kenya. Other necessary logistical arrangements were done with the relevant mixed martial arts federations who in addition gave the contacts of their various athletes in the various areas of the country.

## RESULTS

**Gender**

Majority of the participants in Mixed Martial Arts are male at 79.9%. The age distribution per discipline are presented in Figure 1. Taekwondo registered the highest percentage of females participants while weight lifting recorded the least number of female participants.

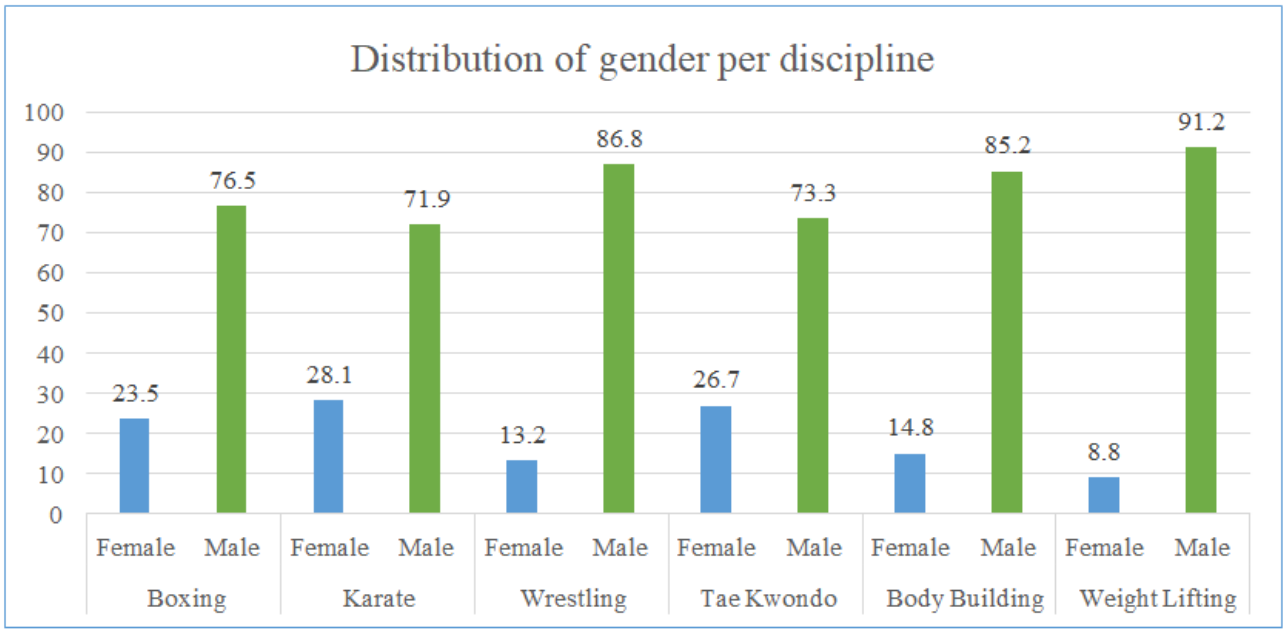



**Figure 1: Gender distribution per discipline**

**Age**

The mixed martial arts participants' age ranged from 18 to 54 years old with a median age of 25. The mean age was 26.8±4.1 and their distribution per discipline are presented in Figure 2.

The age distribution amongst the athletes of MMA were significantly different ($p<0.001$) as shown in Table 2.

**4.2 Experience in years of participating in the mixed martial arts**

The number of years with which an athlete participated in any sports is important, in that the longer the experience the more the exposure to risks of doping. Wrestlers reported the highest mean years of experience followed by those participating in Karate. Taekwondo participants reported the lowest mean years of experience.

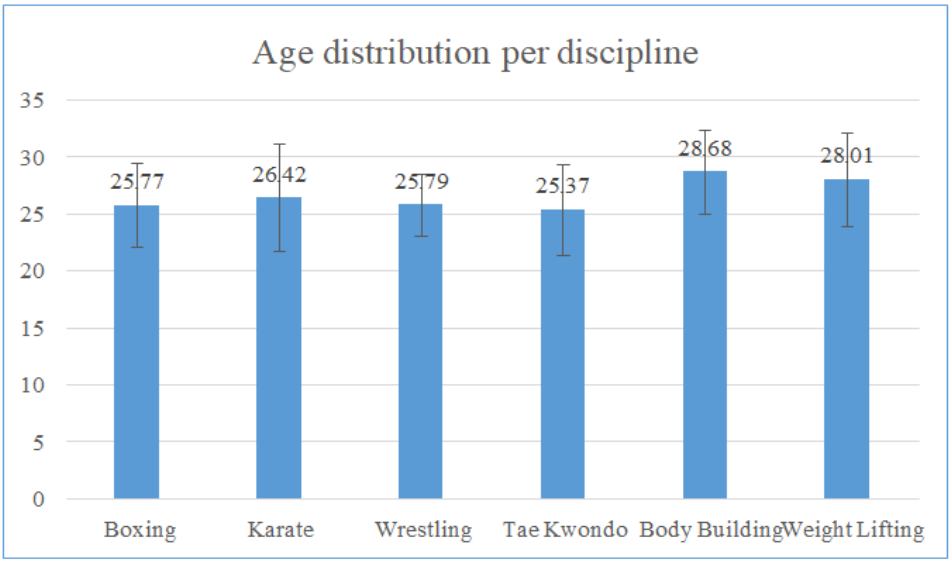
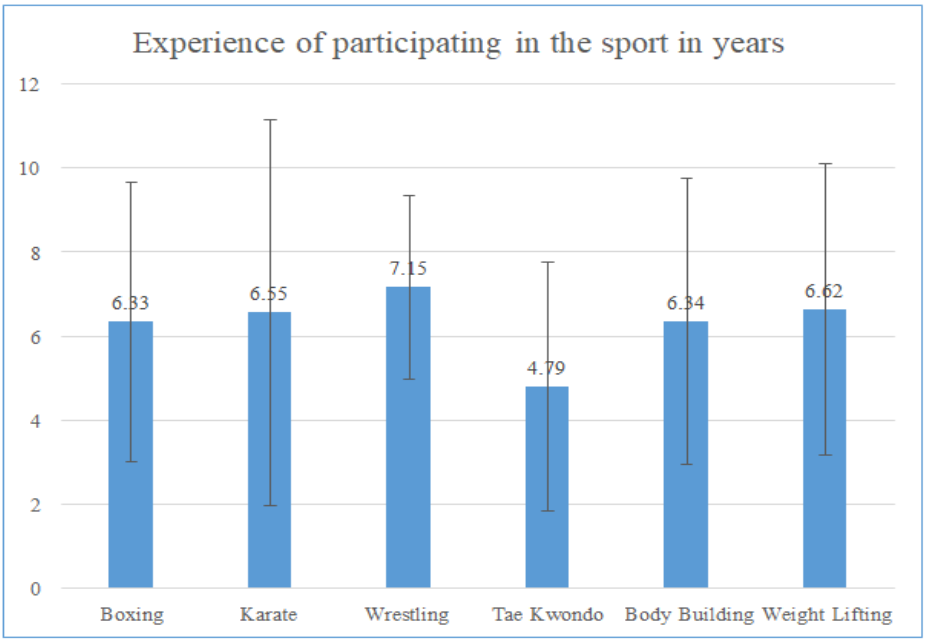



**Figure 2: Age distribution per discipline**

**Table 2: Mean age (years) and Experience in their sport (years)**

| Discipline | Athlete Age (years) | Athlete Experience (Years) |
|---|---|---|
| 1. Body building (n=169) | 28.7 ± 3.6[b] | 6.3 ± 3.4[b] |
| 2. Tae Kwondo (n=146) | 25.4 ± 3.9[a] | 4.8 ± 2.9[a] |
| 3. Weight lifting (n=113) | 28.0 ± 4.1[b] | 6.6 ± 3.5[b] |
| 4. Boxing (n=162) | 25.8 ± 3.7[a] | 6.3 ± 3.3[b] |
| 5. Karate (n=128) | 26.4 ± 4.8[a] | 6.6 ± 4.6[b] |
| 6. Wrestling (n=53) | 25.8 ± 2.7[a] | 7.2 ± 2.2[b] |
| p-value | <0.001 | <0.001 |
| Means in the same column with the same superscript are not significantly different | | |

The Tae-Kwondo athletes were significantly younger than the body builders and weightlifters, but not significantly different from the Boxers, Karate athletes and Wrestlers in their age. The same Tae-Kwondo athletes were however significantly different from the other Mixed Martial Arts athletes regarding their experience (in years) in their sport. This could be an indication that the Tae-Kwondo is a martial art that athletes recently started participating in.



**Knowledge level assessment of participants of mixed martial arts**

The knowledge of the participants was measured using a set of 16 Likert scale questions which were answered by the athlete whether each of the questions was true, false or they do not know. The results of this knowledge assessment are presented in Table 4.2. In order to get the aggregate knowledge levels, the correct answers were labelled 1 and incorrect ones labeled 0, those who did not know were also labeled 0. The aggregate of the 16 questions created a composite variable of the knowledge score.

**Table 3: Knowledge questions and responses: How well informed are you about the following procedures with regard to Food Supplements (FS), Traditional Herbs (TH) and Performanceenhancing (PES) and Methods**?

| Question | True | False | Don't Know | Correct Answer |
|---|---|---|---|---|
| ADAK can tell me which nutrition supplements are safe to use? | 44.1% | 37.2% | 18.7% | 37.2% |
| If a food supplement is bought from the pharmacy (over-the-counter), it must be safe for an athlete to use. | 14.8% | 76.8% | 8.4% | 76.8% |
| If a food supplement contains a prohibited substance, it will always say so on the label | 8.3% | 84.4% | 7.3% | 84.4% |
| I can be sanctioned if I test positive after taking what I thought was a safe food supplement | 88.2% | 3.4% | 8.4% | 88.2% |
| ADAK can tell me which Traditional Herbs are safe to use? | 29.3% | 44.4% | 26.3% | 44.4% |
| If a Traditional Herb is bought from a herbalist (or over-the-counter), it is definitely safe for an athlete to use | 12.1% | 75.9% | 12.1% | 75.9% |
| If a Traditional Herb contains a prohibited substance, my coach/team doctor/physiotherapist would know. | 11.8% | 77.3% | 10.9% | 77.3% |
| I can be sanctioned if I test positive after taking what I thought was a safe Traditional | 85.5% | 3.2% | 11.3% | 85.5% |
| ADAK can tell me which Performanceenhancing Substances are safe to use? | 42.0% | 37.9% | 20.1% | 37.9% |
| If a Performance-enhancing Substance is bought from the pharmacy (over-the-counter), it must be safe for an athlete to use. | 16.6% | 75.0% | 8.4% | 75.0% |
| If a Performance-enhancing Substance contains a prohibited substance, my coach/team doctor/physio would know. | 15.7% | 74.8% | 9.5% | 74.8% |
| I can be sanctioned if I test positive after taking what I thought was a safe Performance-enhancing Substance | 89.1% | 3.2% | 8.4% | 89.1% |
| Boosting your blood levels can lead to an athlete testing positive for performanceenhancing methods | 88.8% | 2.7% | 8.4% | 88.8% |
| Manipulation of blood components in an athlete is prohibited in sports | 90.8% | 1.8% | 7.4% | 90.8% |
| Manipulation of blood components can lead to transfer of infectious disesases or even death | 93.6% | 1.3% | 5.1% | 93.6% |
| A doctor or physician or paramediacal personnel assisting athltes to manipulate their blood components can be sanctioned together with the athlete if the athlete tests positive for a prohibited method | 80.3% | 8.8% | 10.9% | 80.3% |

On the question of whether a NS bought over the counter at a Pharmacy was safe for use or not, 14.8% of the respondents responded True while 76.8% responded False and 8.4%% responded by saying they did not know. In this case about over three quarter of the MMA athletes were correctly aware that buying of NS over the counter at a pharmacy were not necessarily safe. It is in the interest of ADAK to reach the remaining quarter who do not know that over the counter purchase of a NS does not make them safe. This should be emphasized during information sharing forums such as the educational workshops and outreaches where athletes as well as coaches are being trained. Behaviour Change Communication (BCC) is immediately advisable with this case where all athletes should have a slogan that they are not supposed to buy any medicine or NS over the counter. This BCC can be done through the use of the coaches, or the mass media such as adverts in the TVs and Radio stations without forgetting the ever growing social media platforms.

On the question on if a NS had a prohibited substance it would always be written on the label, 8.3% responded True, 84.4% responded False while 7.3% responded Don't know. This infers that majority of the athletes were correct that if a NS had a prohibited substance it is not usually written on the label. Thus, it is important for ADAK to educate the athletes to target the few without such knowledge in order to avoid committing an ADRV. It is known that the NS industry is largely unregulated thus contaminated and counterfeit products reach the clueless athletes who suffer the consequences of being caught with ADRV without ever knowing its source.

On whether the athletes can be sanctioned if they tested positive after taking what they thought was a safe NS, 88.2% responded True, 3.4% responded False while 8.4% responded don't know. Most of the athletes were knowledgeable about being sanctioned if they tested positive, however the remaining 11.8% need to be reached with the information that sanctioning is

applicable even when they thought that the NS was safe. Such athletes face the law and sanctions for testing positive even when they are clueless about the source of the banned substance. This therefore implies that the "Rule of Strict Liability, which states that the athlete is ultimately responsible for whatever is found in their bodies" be emphasized at all times for these athletes to understand that whatever they take they are responsible individually even if they were given by people or sources they trusted.

**Table 4: Mean knowledge score per discipline (Number correct out of 16 questions)**

| Discipline | Mean Score ± SD | Comment |
|---|---|---|
| 1. Body building (n=169) | 10.93± 3.93[a] | Low score |
| 2. Tae Kwondo (n=146) | 11.10±4.52[a] | Low score |
| 3. Weight lifting (n=113) | 12.30±3.81[b] | Medium Score |
| 4. Boxing (n=162) | 12.52±3.11[b] | Medium Score |
| 5. Karate (n=128) | 12.63±3.88[b] | Medium Score |
| 6. Wrestling (n=53) | 14.05±2.41[c] | High Score |
| p-value | <0.001 | |
| Means with the same superscript are not significantly different | | |

The study found that the Wrestlers were the most knowledgeable amongst the MMA athletes with a mean score of 14.05 out of a maximum of 16. This was significantly different from the other Sports as shown in Table 4.3. The body builders had the least knowledge score at 10.9 out of 16. There was no significant differences in the knowledge scores amongst the females and the males at 12.43 and 11.89 mean scores out of 16 respectively (p=0.118).

**Assessment of participants of mixed martial arts attitude towards doping**

The assessment of attitude was measured by asking participants questions related to how they feel towards doping practices in Kenya. The results are presented in table 5: A composite variable was developed from the Thirteen (13) questions indicated in Table 4.4. The respondents with the correct attitude towards doping were coded with one(1) and those with incorrect attitude were coded zero (0). The sum of the attitude scores made up the composite variable named Attitude score. This variable was used to measure the mean value of correct attitude towards doping amongst the sports disciplines.

**Table 5: Assessment of the athletes attitude towards doping**

| | Question | Agree | Disagree |
|---|---|---|---|
| 1. | Food Supplements are necessary in competitive sport. | 28.3% | 71.7% |
| 2. | Food Supplementation is not cheating since everyone does it. | 16.6% | 83.4% |
| 3. | Athletes often lose time due to injuries and Food Supplements can help to make up the lost time. | 24.0% | 76.0% |
| 4. | Only the quality of performance should matter, not the way athletes achieve it. | 11.7% | 88.3% |
| 5. | Athletes are pressurized to take performance-enhancing substances. | 31.6% | 68.4% |
| 6. | Athletes, who take recreational drugs, use them because they help them in sport situations. | 32.7% | 67.3% |
| 7. | Athletes should not feel guilty about breaking the rules and taking Performance-Enhancing Substances. | 9.6% | 90.4% |
| 8. | There are risks related to use of supplements in sports. | 82.4% | 17.6% |
| 9. | Athletes have no alternative career choices, except sport. | 4.5% | 95.5% |
| 10. | Performance-Enhancing herbs and supplements should be legalized | 14.3% | 85.7% |
| 11. | Traditional herbs and supplements are an unavoidable part of competitive sport. | 11.0% | 89.0% |
| 12. | Traditional Herbs and Food Supplements help to overcome boredom during training. | 89.4% | 10.6% |
| 13. | There is no difference Performance-Enhancing Substances, fiberglass poles, and speedy swimsuits that are all used to enhance performance. | 14.5% | 85.5% |

**Table 6: Mean Attitude score per discipline (Number correct out of 13 questions)**

| Discipline | Mean Score ± SD | Comment |
|---|---|---|
| 1. Body building (n=169) | 9.28±3.43[a] | Low score |
| 2. Weight lifting (n=113) | 10.36±2.73[b] | Medium score |
| 3. Tae Kwondo (n=146) | 11.05±2.72[bc] | High Score |
| 4. Boxing (n=162) | 11.23±2.38[c] | High Score |
| 5. Karate (n=128) | 11.59±1.63[c] | High Score |
| 6. Wrestling (n=53) | 11.60±1.35[c] | High Score |
| p-value | <0.001 | |
| Means with the same superscript are not significantly different | | |

The body builders had the lowest mean attitude score, meaning that they have the worst attitude towards anti-doping in sports and therefore are the most vulnerable to dope. They are closely followed by the weight lifters who also had a similar significantly lower score. The other MMA disciplines had similar high scores, which were not significantly different from each other, but significantly higher than those of the bodybuilders and weightlifters.

In comparison by gender, the females had a significantly higher attitude score compared to the male athletes at 11.19 and 10.61 respectively (p=0.020). This indicates that the males are more likely to dope due to their significantly lower attitude towards anti-doping compared to the female MMA participants.

## DISCUSSION

### Demographics and Experience

The demographic trends in this study, with a significant majority (79.9%) of Mixed Martial Arts (MMA) athletes being male, align with general patterns in combat sports. This gender imbalance is often seen due to social and cultural influences that traditionally depict combat sports as male-dominated activities (Smith, Smith, & Stewart, 2008).

The age distribution of MMA athletes, with a range from 18 to 54 years and a mean age of 26.8±4.1, reflects the broad appeal of these sports. The younger demographic in Taekwondo could be attributed to its emphasis on agility and flexibility, attracting younger participants (Souza-Junior *et al*., 2015). The older demographic in bodybuilders and weightlifters, with mean ages of 28.7 and 28.0 respectively, could be due to the extensive training and physical development required in these disciplines (Westney, 2012).

Experience levels differ among disciplines, with Wrestlers having the most years of experience, indicating the longevity of this sport in Kenya (Rintaugu, Mwisukha, & Munayi, 2011). This contrasts with Taekwondo, which has the lowest mean experience, suggesting it's a more recent addition to the Kenyan MMA scene.

### Knowledge Level

The knowledge assessment reveals varying levels of understanding regarding food supplements, traditional herbs, and performance-enhancing substances (PES). The low knowledge scores among Bodybuilders (10.93 out of 16) indicate potential risks of inadvertent doping due to misconceptions about the safety of over-the-counter supplements (Henning & Dimeo, 2014). Wrestlers, with the highest mean knowledge score (14.05), suggest that longer-established sports might have better Anti-Doping education programs.

A key finding from the knowledge assessment is the significant misconception among athletes regarding the safety of over-the-counter supplements. Only 14.8% of athletes believed these supplements were safe, indicating a substantial risk for inadvertent doping. This supports the need for comprehensive education and awareness campaigns to address these misconceptions (Mahomoodally, 2013).

### Attitudes Toward Doping

The attitude scores suggest that Bodybuilders and Weightlifters are more vulnerable to doping, with lower scores of 9.28 and 10.36, respectively. This could be due to the pressure to achieve physical ideals in these sports (Schneider, 2016). The higher attitude scores among Taekwondo, Boxing, Karate, and Wrestling indicate a more favorable attitude toward anti-doping practices. This might be due to stricter regulations and better Anti-Doping education in these disciplines (Kamenju *et al*., 2016).

The gender differences in attitude scores reveal that females have a significantly higher attitude score (11.19) compared to males (10.61). This finding is consistent with studies indicating that female athletes may have a stronger attitude toward fair play and anti-doping due to societal expectations and a lesser emphasis on physical dominance compared to their male counterparts (Chebet, 2014).

These findings suggest a need for targeted Anti-Doping education and awareness campaigns, particularly among male athletes and disciplines with lower knowledge and attitude scores. Addressing misconceptions and promoting a culture of fair competition can help mitigate the risks of doping in MMA.

## CONCLUSION

The study on Mixed Martial Arts (MMA) athletes in Kenya highlights a number of significant findings, with a focus on demographics, knowledge levels, and attitudes toward performance-enhancing substances (PES). The gender distribution reveals a significant majority of male athletes (79.9%), indicating a potential need for increased gender diversity and inclusion in MMA. Age distribution findings suggest that Taekwondo attracts a younger demographic, while bodybuilders and weightlifters tend to be older, indicating variations in career longevity and experience.

The knowledge assessment reveals varying levels of understanding among MMA athletes regarding food supplements, traditional herbs, and PES. A concerning number of athletes harbor misconceptions, particularly about the safety of over-the-counter supplements, highlighting the risks of inadvertent doping. Attitude scores indicate a vulnerability to doping, particularly among bodybuilders and weightlifters, with lower attitude scores suggesting a more lenient perspective on anti-doping practices. Gender differences in attitudes toward doping show females with a more favorable outlook, suggesting the

need for targeted education and awareness among male athletes.

## RECOMMENDATIONS

Based on the findings, several recommendations can be made to address the issues identified:

1. **Enhanced Education and Awareness Programs**: Given the misconceptions surrounding food supplements and PES, there is a need for comprehensive educational campaigns. These should target athletes with lower knowledge scores and address common myths about supplement safety.
2. **Gender Diversity Initiatives**: To improve gender diversity in MMA, initiatives should focus on attracting more female athletes to combat sports. This can be achieved through targeted outreach programs and creating supportive environments for female participation.
3. **Tailored Anti-Doping Interventions**: Considering the vulnerability to doping among bodybuilders and weightlifters, specialized anti-doping programs should be developed to address the pressures and challenges unique to these disciplines. These programs should focus on the risks and consequences of doping, emphasizing a culture of fair competition.
4. **Gender-Specific Education**: The significant gender differences in attitude scores suggest that male athletes may require additional education on anti-doping practices. These programs should aim to shift attitudes toward a more correct and positive perspective on anti-doping.
5. **Collaboration with Sports Authorities**: Strengthening collaboration with sports authorities and anti-doping agencies, such as the World Anti-Doping Agency (WADA), can ensure that athletes have access to reliable information and resources. This collaboration can also aid in implementing stricter anti-doping regulations and enforcement.

**Declarations**

**Competing Interest:** The author declare that they have no competing interests.

**Authors& contributions**

Martin Sisa Yauma conceived the paper, designed and performed the study. The author read and approved the final manuscript.

**Disclaimer**

The findings and conclusions presented in this manuscript are those of the authors and do not necessarily reflect the official position of Anti doping agency of Kenya.

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